INFRARED STUDY OF HYDROGEN BOND TYPES IN ASPHALTENES

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ABSTRACT

The structural characteristics of asphaltenes are important to refiners for determining the yields from the residual fraction of crude oils and the operating parameters of the process units for deep conversion processes. In this paper, we studied the hydrogen bonding distribution of four Saudi Arabian crude-oil-derived asphaltenes against the phenol solutions of various concentrations in carbon tetrachloride. In an attempt to explain relative hydrogen bonding capabilities of asphaltenes, OH peak intensity of phenol and enthalpies of hydrogen bond formation were used in combination with the content of heteroatoms (N, O & S) in asphaltenes. The OH peak intensity of phenol depends on the presence of acidic and basic moieties or functional groups on the surface of asphaltenes. The results obtained show that the asphaltenes with high oxygen and low nitrogen contents have poor interaction with phenol, which indicates that oxygen might be incorporated as acidic hydroxyl groups in asphaltenes. In a similar way, asphaltenes with low oxygen and high nitrogen contents give high phenol interaction values. Piperidine was also tried to evaluate the hydrogen bonding capabilities of NH group with the asphaltenes. The trace metal and GPC molecular weight measurements showed that the Arab heavy asphaltenes possess highest molecular weights and maximum V & Ni contents.